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EDITOR'S NOTE

INSA is committed to the growth of natural knowledge in India and its application to the problems of national welfare. Being the adhering body in India for the ICSU, the Academy is entrusted with deputing Indian delegations to various international conferences and symposia. Since its inception in 1935, INSA has endeavoured to promote the dissemination of scientific knowledge and matters concerning science policy and philosophy of science. The Fellows of the Academy have played a major role not only in practising science but in actively participating in professional meetings the world over.

Realizing that the three scientific journals being published by the Academy are primarily devoted to the communication of scientific research findings, a new quarterly journal has been started to cover international science news and present delegation reports to the Fellowship and to the Indian scientific community at large. The contents of the journal cover: *(i)* reports of General Assembly meetings of ICSU and other organizations; *(ii)* reports of INSA delegations sent abroad; *(iii)* brief accounts of individual scientists sponsored by INSA to attend conferences; *(iv)* highlights of international conferences in specialized areas of research; *(v)* experiences of scientists under Inter-Academy exchange programme; *(vi)* summaries of lectures delivered by distinguished scientists and *(vii)* excerpts of news-worthy items from leading international scientific journals.

Through this publication, the Academy aims to spread current developments in scientific knowledge and to ascertain view on values and judgements in science and technology.

It has been three years now since the idea of publishing the delegation reports was first conceived. We have been receiving objective reports of the delegates sponsored to various international conferences and symposia. Apart from reporting to the Academy about their individual contributions to a given conference, the delegates are expected to focus attention on its main theme as well as highlight the major conclusions for the benefit of the wider community. This will provide an overall picture of the conference to the interested reader and thus help in meeting the basic obligations of the journal.

The number of write-ups received by us in last three years were much more than could possibly have been included in this journal. In order to cover the maximum number of conferences/symposia, some of these reports are being included as short communications, and more such items are envisaged in the forthcoming issues. We also look forward to suggestions for improving the contents and scope of this journal.

A N Mitra

INTERNATIONAL SEMINAR ON SAFETY AND STANDARDISATION ISSUES IN DIAGNOSTIC ULTRASOUND IN OBSTETRICS : A REPORT*

1. INTRODUCTION

One of the functions of the 'World Federation for Ultrasound in Medicine and Biology' (WFUMB) is to promote international standards relating to the use of medical ultrasound. Keeping this in view a two-and-a half-day seminar was organized by WFUMB on "Safety and Standardisation issues in Diagnostic Ultrasound in Obstetrics." The seminar was aimed to focus on all aspects of pregnancy diagnosis by ultrasound, whether by *B*-mode, static or real time imaging, and by continuous as well as pulsed Doppler ultrasound. It was planned to hold it just after the Fourth Meeting of the WFUMB for better participation and was held at the Manly Pacific International Hotel, Sydney, Australia during 22—24 July 1985.

1.1 Participants

The participants were selected from internationally acclaimed experts in the field and the expences for stay and food etc were paid from the WFUMB funds for all the participants. As all delegates attending this meeting were recognised experts in research or clinical applications of ultrasound and had a good working knowledge of the subject, the time spent on basics was always kept minimal during the delibrations. A total number of 45 delegates were invited from all over the world, out of which 42 were delegates from 12 countries (Australia, Belgium, Canada, Denmark, Germany, India, Indonesia, Japan, Netherland, Switzerland, UK and USA) participated in the seminar.

1.2 Background Information

Ultrasonic has been in regular use in medical diagnosis for over 15 years now. Ultrasonography started as a very specialized laboratory tool for measuring depths in interval surfaces by A-mode ranging techniques. It has shown remarkable growth and progress and today is employed in every major medical centre and even in many private physicians clinics. Perhaps the most important reasons for the popularity of ultrasound, in addition on its excellent capability for visualizing and differenciating soft tissue are its non invasive nature compared to surgical methods and lack of any known harmful effects on patients.

*Based on the delegation report of Dr V N Bindal, National Physical Laboratory, New Delhi.

In applying a benefit-risk-ratio criteria to this procedure, the physician percieves a definite benefit but only a possible small risk. This has led justifiably to the question is the present practice of using ultrasound is safe under all circumstances.

It so happens the application of Ultrasound in obstertics are numerous. Due to which literally millions of patients have had ultrasonic examinations and the number of such examination increases each year. It is now estimated that over half of all pregnent women in United States have at least one ultrasound examination during their pregnancies. This implies that soon over half of US population will have been exposed to ultrasound prior to birth.

Because of this vast exposure of the general population to ultrasound any question of the possibility of adverse effects or harm becomes very important.

1.3. Objective of Seminar

It was planned that the meeting will cover various aspects of bioeffects/safety and dosage standardization and will involve a mixture of joint and concurrent session of these two complementary fields.

The overall theme will be safety of clinical ultrasound and development of quantitative exposure criteria, and the findings will be published in the Journal, *Ultrasound in Medicine and Biology*. It was convened with the aim of providing a form in which International consensus is present, to identify matters on which agreement has not been reached and to set directions for further studies and research. The theme of the meeting was restricted to the discussions on current of ultrasonic bioeffects and quantification of dosage parameters.

2. ESTABLISHING EXPOSURE CRITERIA FOR MEDICAL ULTRASOUND

2.1 Risk/Benefit Ratio

Questions regarding wise usage of diagnostic ultrasound continue to arise and it is imperative to develop satisfactory ways to answer them. Medical decisions must be based on considerations of benefit as well as risk and, ideally, would be based on quantitative information. Evidently the benefit varies from one situation to another, and it is reasonable that the risk (considered here to be always present, although it may usually be extremely small) should also vary. This complicates any attempt to formulate criteria, guidelines or recommendations, whether these are for marketing of medical devices or are for use in medical practice. However, in spite of problems, the task of formulating recommendations should be undertaken. Judgements has to be made by physicians, sonographers, manufacturers, professional organizations and government agencies; in fact, they are already being made. These judgements should be based on the most relevant information and the best analysis possibe.

2.2 Dosage Standardisation

2.2.1 The NCRP Committee

The National Council of Radiation Protection and Measurements (NCRPM) has formed a committee and given it a mandate to carry out studies "with the long term view of needs relative to the development of exposure criteria" for human exposure to ultrasound. The members of this committee are : P L Carson, E L Carstensen, F Dunn, D L Miller, M W Miller, W L Nyborg (Ch), H E Thompson and M C Ziskin. It is expected that the activity will be an ongoing one for many years, and that it will involve cooperation and communication with many individuals and groups around the world.

2.2.2 The AJUM/NEMA Standard and the IEC Standard for Ultrasound Exposure Measurement

The American/Institute of Ultrasound in Medicine/National Electrical Manufacturers Association (AIUM/NEMA) Safety Standard for Diagnostic Ultrasonic Equipment was published in 1981 and covers the definitions of coustic output parameters relating to acoustic output levels, together with acoustic output levelling requirements and test methods. The main theme of the Standard is the specification of ultrasonic intensity parameters, and for lebelling purposes specifies only temporal-average quantities although including the spatial-peak pulse-average (SPPA) intensity. It recommends that all equipment be subject to the same levelling requirements irrespective of their acoustic output levels. As far as maximum limits are concerned, valuable information is provided on the bioeffects of ultrasound together with guidelines for its safe and effective use.

2.2.3 The International Electrotechnical Commission (IEC)

It has been working for some time on the development of standards as the bases of reference measurement methods for the determination of the acoustic output of all medical ultrasonic equipment. Initially, a Standard was produced for the characterisation and calibration of hydrophones, the calibration technique adopted being reciprocity. More recently, a draft Standard for the calibration of hydrophones by the planar scanning method has been prepared and brings the IEC and AIUM/NEMA approaches into line. A separate Standard is being developed for the measurement of total ultrasonic power using radiation pressure balances.

The characterisation of ultrasonic fields with hydrophones is now covered by a draft Standard which provides definitions of a wide range of primary acoustic pressure parameters (those measured directly by the hydrophone), and a corresponding set of derived intensity parameters. Agreement has now been reached which will ensure that there is consistency between the derived intensity parameters determined

according to the IEC Standard and those determined according to the AIUM/NEMA Standard. The IEC Standard also gives measurement methods for the reliable determination of the parameters, and is intended to cover all ultrasonic fields propagating in water.

The next stage for the IEC will be the preparation of acoustic output levelling requirements specifically for medical ultrasonic equipment. It is hoped that this can be achieved in a manner which will relate the requirements to acoustic output levels. The emphasis of the IEC field characterisation Standard is on the specification of primary acoustic pressure parameters as acoustic pressure is the measured quantity. In addition, as peak acoustic pressure, both positive and negative, are likely to be most relevant to nonthermal effects of ultrasound these may also be most appropriate for acoustic exposure paramaters. Where thermal effects are most relevant, it is possible to derive the ultrasonic intensity provided it is valid to make the usual assumption that particle velocity and acoustic pressure are in phase. It is envisaged that only a few of the acoustic parameters given in the IEC Standard will be used for acoustic output levelling.

2.2.4 Japanese Policy and Statement

The safety of diagnostic ultrasound was studied by the Japanese study group supported by the Ministry of Health and Welfare in 1972-1976 for CW ultrasound and 1977-1979 for pulsed one.

The standard experimental generators were used in both studies. The effect of the ultrasound was investigated in the changes of chromosome, cell growth, fertilized animal ovum, the fetal animal etc. After the exposure to CW ultrasound, anomalous change of the fetal animal was observed at the intensity of about 1W/cm^2 or more, and the cultured cell growth was suppressed. As for the pulsed ultrasound, the cultured cell growth was the most sensitive, and no effect was observed when SPTA intensity was 240 m W/cm^2 or less in exposure. The statistics showed no increase of neonatal anomaly rate after introduction of the antepartum ultrasound diagnosis. The fertilized rat ovum was exposed to diagnostic pulsed ultrasound for 12 hrs, and the ovum was transferred into the animal uterus resulting in normal fetal growth without anomaly. The committee for the Standards on Ultrasonic Medical Equipment, Japan Society of Ultrasonics in Medicine, stated the results as "Views on Safety of Diagnostic Ultrasound" in 1983. They had come to the conclusion regarding the minimum intensity of ultrasound showing reproducible biological effects, when the irradiation time ranged from 10sec to 1.5 hr in the frequency range of a few MHz, that it was approx. 1W/cm^2 when CW ultrasound was irradiated, and approx. 240m W/cm^2 (SPTA) in pulsed ultrasound. Japan Industrial Standards on the diagnostic ultrasound devices limited the ultrasound intensity at definitely low level.

2.2.4.1 Status of Standardisation

Many ultrasonic diagnostic equipment produced in Japan are used inside of Japan and are also exported. Accordingly its safety is a matter of interest. Main Japanese organizations which are delibrating on the Safety Standard of diagnostic ultrasound are as follows:-

(a) JSUM (Japan Society of Ultrasonics in Medicine)

(b) JIS (Japanese Industrial Standards) Committee

(c) IEC (Japanese National Committee)

JSUM recently published its view on the safety of diagnostic ultrasound. JIS is National Standard and following JIS standards on ultrasonic diagnostic equipment have been produced.

(i) A-Mode Ultrasonic Diagnostic Equipment

(ii) Manual Scanning B-Mode Ultrasonic Diagnostic Equipment

(iii) M-Mode Ultrasonic Diagnostic Equipment

(iv) Ultrasonic Doppler Fetal Diagnostic Equipment

(v) General Rules of Performance Test of Pulse Echo Equipment

JIS Draft of Electronic Linear Scanning Ultrasonic Diagnostic Equipment was completed last spring. Most interesting matter specified in the draft is ultrasonic power and its measuring procedure. The draft specified that maximum output ultrasonic power shall be less than 10m W/cm^2. This value was determined by the reported values on the bioeffects regarding the safety margin. The ultrasonic power of the equipment is measured by radiation force method, is most practical one of the measuring methods, by which the absolute values can be obtained precisely. In case of the electronic scanning equipment, however, the measurement of the output power/unit area is not so easy for the beam is moved. So, in this draft, measurement is made under the condition that the electronic scanning is stopped. From the obtained value in the fixed aperture, actual power/unit area is calculated by considering the frame rates and aperture sizes.

3. ULTRASONIC STANDARDISATION AND SAFETY PROGRAMME IN INDIA

3.1. Current Status

Ultrasonics in medicine, both in therapeutic and diagnostic area, is in use in India for quite some time. Although sophisticated equipment is not available from indegenous sources, manufacture of equipment like ultrasonic therapy unit, foetus monitor, echoencephalograph and blood flow meter is very common. There are more than a

dozen manufacturers who are involved in the production of ultrasonic equipment for medical applications. Increasing use of these equipments and steady increase in the number of their manufacturers has created a need of establishing ultrasonic standardisation and safety regulations in the country.

Still there is very little effort going on the safety and measurement in the area of diagnostic applications in India. It is due to lake of facilities accessible ultrasonogrophers and also due to lack of awareness in this direction, Today in India most of the equipments used for diagnostic applications are imported at the moment. It is, therefore, taken for granted that all such precautions like power levels and its standardisation, and calibration must have already been taken up by the manufacturer, and the equipment is quite safe for use.

3.1.1 Work at NPL

The work at National Physical Laboratory in this area, consists of outlining the parameters to be measured, laying down specifications, and to establish a complete facility for carrying out these measurements, together with the development of suitable methods wherever necessary.

A capacitance microphone is already in use to measure the vibrational amplitude of pulsed ultrasound. Ultrasonic hydrophones and other suitable systems would eventually be developed to decipher the SPTA and SATA intensity. A technique has also been developed using absorption measurements to characterize the band width of the probes used in pulsed ultrasonic system. It is seen from the literature that there is a great need of SPTP intensities date of the pulsed ultrasound exposure for proper understanding of the effect on biological systems. There is, therefore, an urgent need to develop routine methods of measurement of pulsed ultrasonic power. Work on the development of standards for characterising the performance of ultrasonic diagnostic equipments is under way.

3.1.2 Status at Medical Establishments

In India, development work regarding diagnostic ultrasonic has created a great interest among the research establishments. A survey conducted on the status of diagnostic ultrasonic activity in our country, reveals that five national laboratories, elevan universities, ten hospitals and four other major research establishments are engaged in ultrosonic diagnostic, tissue characterisation and other biomedical research. The work at these places, pertains to studies in a wide variety of diagnostic applications. It varies from its application in opthalmology to investigations concerning ultrasonic cardiography, abdominal scanning and to some areas in obstetrics and gynaecology, using A, B and M scanning techniques.

The number of ultrasonographers is steadily increasing as hundreds of public and private hospitals have become extensive users of diagnostic equipment over the last decade.

Inspite of all the interest the investigations leading to safety aspect possible health risks resulting from exposure to ultrasound are very much lacking.

3.2 Work Plan

The following parameters have been identified for the measurement.

Ultrasonic intensity

Ultrasonic total power

Ultrasonic vibration amplitude

In addition to the measurement of above parameters, facilities for visualisation ultrasonic field, may also be set up.

3.2.2 Range and Accuracies

The range and accuracies for the above parameters are shown in Table 1.

TABLE 1

Ranges and accuracies of standards of ultrasonic parameters at various levels

Parameters	*Symbol*	*Frequency*			*Accuracy of Standards*		
		Ech. I	*Ech. II*	*Ech. III*	*Ech. I*	*Ech. II*	*Ech. III*
1. Ultrasonic Intensity ($0.1mW/cm^2$ to $1W/cm^2$)	I	0.5 to 15MHz	Same As in I	1 to 10MHz	1.5dB	2.5dB	3.5dB
2. Ultrasonic Total Power	P	0.5 to 15MHz	0.5 to 10MHz	Same as in II	5%	10%	15%
i) Low (0.1mW to 1W.							
ii) Medium (1 to 25W)		0.5 to 3MHz	0.5 to 1MHz	Same as in II	10%	15%	20%
3. Ultrasonic Vibrational Amplitude (10mm)		0.5 to 50MHz	—	—	0.05mm	—	—

3.2.3 Methods for Measurement of these Parameters at Echelon I, II and III Levels

3.2.3.1 Methods for Ultrasonic Intensity

(a) The measurement of ultrasonic intensity can be carried out in the following two days. The method presently being adopted is to use miniature ultrasonic probe hydrophones calibrated by reciprocity technique for measurement of the spatial and temporal intensity distribution of transducers. The second method employs laser interferometry which is a modified Michelson interferometer incorporating an electro-optical cell connected in a feedback loop to compensate for external vibration. Both the methods are capable of yielding an accuracy of Echolon-I level.

(b) A PVDF hydrophone of miniature or laminar type calibrated by any one of the above techniques can be used as secondary standard at the Echelon-II level.

(c) For a working standard of the Echelon-III level, the use of a miniature piezoelectric ceramic hydrophone is suggested. These hydrophones can be calibrated by comparison with standard PVDF hydrophones.

3.2.3.2. Methods for Ultrasonic Total Power

(a) A number of methods to measure total ultrasonic power are possible such as radiation pressure, calorimetric, motional impedance etc. The method presently adopted, for measurement of high power levels, is to measure radiation pressure impinging on a float, in a fixed path system. The method is suitable for Echelon-II..... but with higher sophistication can yield an accuracy of Echelon-I level.

(b) For the low power range, the ultrasonic beam would be modulated at a low frequency. The modulated radiation force is processed using a sensitive electromagnetic vibration detector and lock-in amplifier. The system has potential for discrimating against extraneous and environmental noise. The method is capable of yielding the accuracy of Echelon-I level.

(c) For the Echelon-III level, single pan radiation pressure balance and calorimetry method can be used.

3.2.3.3. Methods for Vtbrational Amplitude

(a) The laser interferometry system is proposed to be used a primary standard of vibrational amplitude measurement at the ultrasonic frequencies. A desirable facility is to use a scanner for producing faster scan of the output beam from the interferometer.

3.3.3.4 Schlieren Technique for Beam Visualisation

For visualisation of ultrasonic beam in liquid and solids Schlieren technique, in both C W and pulse mode shall be utilised. The method will cover the frequency range 0. 5 MHz to 5 MHz and can be extended upto 25MHz at power level 100mW.

4. IN VITRO AND IN VIVO EXPERIMENTATION

4.1. *In Vitro* Experimention

There are many exposure systems available for experimentation with *In vitro* cell cultures; these systems include a variety of vessels and surfaces which maintain the aseptic condition of the culture and may affect the incident sound field. For example, it is now understood why polystyrence tube rotation is necessary during insonation to achieve cell lysis. A variety of other physical and biological factors is important in achieving/mitigating against cavitational events : e. g. medium temperature and intercellular gas content. There are two general results from in *in vitro* systems in terms of induction of biological effects from non-thermal exposures of clincial ultrasound:

(i) Stable cavitation can be induced in the presence of tablized gas bodies; the intenidentsities needed to achieve this effect are relatively low (e.g. mW/Cm^2 range), and

(ii Transient cavitation can be induced in gas nucleated fluids with exposure intensities of about $1W/Cm^2$.

For former, fluid eddy-streaming is induced, which can cause cell disruption. For the fornei, cell lysis can be induced; the lytically effective bubbles probably arise in the fluid outside the cell but there is some evidence suggesting the occurrence of intracellular cavitation.

The value of *in vitro* experimentation in terms of health and safety considerations is the mechanism of action of ultrasound on cells can be easily studied.

4.2. Recommendation on *in vitro* Studies

To allow the possibility of extrapolation of effects found in less complex organisms to man, it is necessary to know the mechanism of ultrasound interaction. *In vitro* studies are used pre-dominantly to determine the mechanism(s) by which ultrasound interacts with a biological system. Using a simplified model (e. g. suspension cells or solutions of macromolecules) allows one to identify possible subtle interaction mechanisms. Although *in vitro* studies alone cannot be used to make a health risk assessment, they serve as a useful means of identifying effects that may occur *in vivo* and which should be tested.

The existing bioeffect data base is heavily biased towards continuous wave exposures at therapeutic intensity levels. Well-designed experimental studies are therefore needed which investigate both existing and novel endpoints using short pulses of high intensity ultrasound similar to those emitted by common diagnostic devices.

4.3 Recommendation on *in vivo* Studies

No effect exposure conditions have been identified for the our primary indicators of developmental toxicity in many experiments involving *in vivo* exposure of laboratory

rodents. Most commonly, deleterious effects have been detected only with exposure regimes that are in excess of those that are clinically relevant and are primarily attributable to temperature increases or maternal toxicities. Because of statistical uncertainties, unequivocal determinations of safety cannot be demonstrated by toxicologic evaluations, although it is possible that thresholds can be detected by mechanism-directed animal experimentation. However, it is more likely that, as is the case with other agents and procedures, decisions concerning clinical uses will continue to be based on comparisons with the potential benefits that can be obtained.

4.4 Recommendation on Dosage Specification for Ultrasonic Equipment

Various types of dosage parameters have been suggested, e.g. absorbed dose per unit volume as relevant to certain types of biological effects. Yet, different mechanisms may suggest different dosage parameters. Given that an appropriate ultrasonic dosage parameter has not been identified and that the dosage will vary from patient to patient, with the same equipment, it makes sense at this ti me to specify only equipment output parameters as measured in water.

It has been common practice to discuss output levels in terms of intensity but there are individuals and groups that would prefer to specify acoustic pressure output. Arguments can be made for the appropriateness of each. It is clear that, independent of the parameter used, the output must be specified not only on a time averaged basis, but during the pulses. It is also clear that any attempt to calculate a dose in particular situations requires a knowledge of the time of exposure. The duration of exposure to any portion of the foetus, however, will always be impossible to determine accurately. Nevertheless an equipment timer which is automatically activiate when the transducer is active provides a better estimate of exposure than is currently available.

An increasing number of manufacturers are making output data available on a voluntary basis. It would appear that these data are of sufficient importance to purchasing decisions for the safety conscious physician that manufacturers should make their data available in the standard format, such as that used by the AIUM Manufacturer Commendation panel.

It presently appears premature to specify any limits on equipment output levels.

5. SOME FINDINGS

5.1 Use of Ultrasonic and Dose exposure

It was estimated that anywhere from 15% to 40% of pregnant women receive at leats one ultrasound examination during their pregnancy. This number grossly under-estimates the actual exposure to ultrasound, as Doppler devices for foetal heart monitoring were not included. The intensity of most ultrasound equipment used in obstetrics is

reported in time average values and typically ranges from 0.1-60 mW/cm² (spatial average, temporal average, temporal average intensity) and 1-200 mW/cm² (spatial peak temporal average intensity and spatial peak, pulse average intensity). The surprising finding for the panel was that no dose quantity has been identified for ultrasound. There are no data on the dose to either the mother or the foetus in the clinical setting, due to variables such as scanning time, thickness of material contents, distance of the foetus from the transducer and dwell time. It is recommended that equipment outputs be measured and reported to the user and that specific exposure information be recorded for each patient including exposure to Doppler and foetal monitoring.

5.2 Benefit potential

The panel recognised the enormous benefits ultrasound has brought to obstetrics, it could find no randomized, pressective controlled clinical trial while demonstrated that routine screening was associated with any objectionable outcome either for the foetus or the mother. It became obvious that there are many specific applications of ultrasound which are very beneficial to both the management of the pregnancy and the outcome, but it was surprising that these observations have not been subjected to a controlled clinical trial.

5.3 Risk involved

Though there were many conflicting scientific studies on animals and a number of biological effects have been observed following ultrasound exposure, it was felt that (a) some of the studies employed energy levels greater than would be expected to exist in clinical use, (b) *in vitro* exposure conditions are hard to place in perspective for the risk assessment, (c) some of the observations have not been reproducible, tending to refute the original findings, and finally (d) the justification for applying the results of these studies in the case of humans is yet to be established. Nevertheless, it was felt that some of the effects cannot be ignored or overlooked and deserve further study. A theoretical risk must exist until no ill effects can be demonstrated and some better handle on risk must he achieved before risk/benefit ratio can be a fact.

5.4 Need for Proper Training

It is the concensus of the panel that ultrasound examination in pregnancy be performed for a specific medical indication. The data clinical efficacy and safety do not allow a recommendation for routine screening at this time. Another important limitation on the use of obstetrical ultrasound is that technique is critically dependent upon examiner training and experience, and there are too few adequately trained ultrasonologists to affect a mass screening effort, even if it were proven effications.

The panel recommends minimum training requirements and uniform credentialling for all physicians and sonographers performing ultrasound examinations, and these

individuals should demonstrate adequate knowledge of basic physical principles of ultrasound, transducers, and equipment and keep adequate records of the procedures performed, the indications and the findings.

6. CONCLUDING REMARKS AND RECOMMENDATION

The discussions showed some interesting facts which were somewhat not very surprising to many:

i) We do not understand ultrasound dose to the foetus

ii) We have not proven efficacy of routine screening of all pregnant patients

iii) We have not proven that there are any reproducible adverse biological effects to the fetus at diagnostic power levels presently used

iv) There are insufficient numbers of trained physicians and sonographers to perform the ultrasound examinations, if routine screening were even to be found efficacious

A sustained and supportive research effort is recommended to :

i) Study the fundamental mechanisms leading to bioeffects

ii) Develop laboratory experiments that focus on these cellular processes that are most likely to be affected during embryonic and foetal development

iii) Perform postnatal studies in animals after in vitro exposure to ultrasound

iv) Explore interactions between ultrasound exposure and such agents as drugs, nutrition, ionizing radiation, hyperthermia, and hypoxia, and

v) Develop and improve desimetry.

It is also recommended to fund randomised clinical trails on long term follow-up infants exposed to in utero ulterasound and studies to establish clinical efficacy of ultrasound in reducing morbidity and mortality.

Apart from attending the above conference, the delegate also visited the following three institutes:

VISIT TO ULTRASONIC INSTITUTE, SYDNEY, AUSTRALIA (DIRECTOR DR G KOSSOFF

The Ultrasonic Institute at Sydney works under the Department of Health and its activities cover a wide range of applications concerning the use of ultrasonic waves in the diagnostic and therapeutic area. On the technical side the institute has about 18 people, out of which 10 are Ph Ds who work under the able guidance of Dr G Kossoff. The Acoustic Laboratory situated in the same building provides the administrative infrastrurcture and also library facilities.

Apart from undertaking basic research on the physics of ultrasound, its propagation in tissue and biological effects on tissue, the Institute develops and evaluates techniques and procedures to increase the range of uses of ultrasound in diagnosis. It also provides advisory services and undertakes cooperative projects with other bodies. It has worked with the Bureau of Customs, for instance, in examining ultrasonic technique to detect hidden drugs.

During the past years, the Institute, in confuction with other organizations, also played an active part in educating the medical and para-medical community in Australia about diagnostic ultrasound. These activities include an annual physicians training course of four weeks, held in conjuction with the Royal Hospital for Women, Sydney, which has now trained more than 100 physicians in the past six years.

Advanced Techniques

Research in the Advanced Techniques section centres on application of computer signal processing techniques to extract information on the acoustic properties of tissue from ultrasonic echoes. They are involved in the measurement of attenuation of ultrasound in tissue, and in particular the variation of attenuation at different ultrasonic frequencies.

Engineering Research

The Engineering Research Section carries out research into ultrasonic transducers, transducer array systems and pulsed Doppler techniques.

An annular array transducer system which offers improved scanning resolution and technological improvements, has been developed. For clinical evaluation purposes, the system is presently being installed on a scanner at the Royal Hospital for Women.

Waterbath scanning offers considerable advantages, particularly for deformable organs such as the breast or testis. A project to assess the effect of the skin line contour on waterbath scans is being undertaken to improve the visualisation of these organs by ultrasonic imaging.

Tissue Characterisation

The major research activity of the Tissue Characterisation Section has been to develop examination techniques and diagnostic criteria for application of the measurement of the dynamic behaviour of tissue, as a means of distinguishing abnormal from normal tissue in the clinical environment.

Ultrasonic Imaging

A dedicated breast scanner is now being used routinely to acquire research data on breast disease patients.

The use of continuous wave Doppler to examine suspicious areas in the breast is continuing, and results indicate that this technique allows a significant improvement to be made in the differential diagnosis of small solid lesions.

Biology

The Biology Section has a programme of research aimed at a better understanding of the effect of ultrasound on tissue and establishing safe limits of ultrasonic radiation in diagnostic techniques. The objective of these studies is to evaluate the importance of the factors of pulse peak intensity and pulse accumulation in the safety of diagnostic ultrasound dosages.

II VISIT TO DIVISION OF APPLIED PHYSICS, NATIONAL MEASUREMENT LABORATORY (CSIRO), WEST LINDFIFLD AUSTRALIA (HEAD, ULTRASONIC SECTION : DR K J TAYLOR)

On the suggestion of Dr K Chandra, Acting Director NPL, a visit to Ultrasonic Section of the National Measurement Laboratory, CSIRO, Division of Applied Physics was also made. The ultrasonic section has about six people and is headed by Dr K J Taylor. They are mainly working on development of ultrasonic techniques suitable for the location, identification and characterization of macroscopic defects within solids, and for the measurement of distance and flow velocity in liquids and gases.

Ultrasonic NDT

One important aspect of modern manufacturing in the metals industries is that of assuring the integrity of products. This requires that the position and nature of all defects and discontinuties be known precisely so that their effect on performance of the product can be assessed. Background studies have been made of existing non-destructive testing methods, especially those which use ultrasound. This has enable them to publish a number of educational aids dealing especially with non-destructive testing in the foundry industry. These have been produced with the assistance and under the auspices of the Foundry Industry Research Committee.

Some of the techniques for detecting defects in metals are also appropriate to biological materials and some success has been achieved in detecting specific structures in these materials. Work is proceeding towards the production of an instrument that would be used during surgical operations.

Studies on Bats

Many animals use ultrasound for navigation and to detect and identify other animals and insects, often their prey. Notable in this respect are the bats. A collaborative project with the Department of Zoology of the University of New South Wales has been established to study the ultrasonic techniques used by Australian bats.

Ultrasonic Instrumentation

A device that measures distance by an ultrasonic pulse-echo method has been developed and used successfully in industrial environments. The experience gained with the distance-measuring device has led to developing an ultrasonic method for measuring the level of liquids. In a collaborative project with the Division of Environmental Mechanics, techniques developed for the distance-measuring device are being applied in an instrument for measuring air flow velocities. This device is small and accurate and has a response time of the order of lms. Negotiations are proceeding towards licensing Australian companies to manufacture and market the device as a commercial instruments.

The Ultrasonic section is working in collaboration with the CSIRO Division of Environmental Mechanies, Australian Welding Research Association, foundry Industry Research Committee, University of New South Wales, Department of Zoology for these various projects in hand.

III VISIT TO THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH BANGKOK ACTING DIRECTOR : SRI NANDHASRI

Just a few days before leaving for Sydney, the delegate received an invitation from Dr. Siri Nandhasri, Acting Director, Testing and Standards Centre, TISTR, Bangkok for visiting their institute for a day or two. They are intending to set up NDT facilities with the aim to improve their testing technology and wanted to discuss essential requirements for basic infrastructure.

The Institute has about 220 scientific and technical persons comprising of 15 PhDs, 26 Masters and 129 Bachelors, respresenting different technical disciplines. One of the divisions of TISTR is mainly involved in Instrument Repairing, Calibration and Testing service.

Instrument Repairing & Calibration

Under instrument repairing and calibration service they have developed capability of taking the following tasks.

Repair and calibration of electrical and electronic equipments, for example, multimeters, occilloscopes, standard cells, pH meters, spectro-photometers, drying oven and balances.

Repair and calibration of temperature measuring equipments, such as, potentiometer, temperature controller, furnace, oven, thermocouple, liquid in glass thermometer, resistance thermometer and optical pyrometer.

Calibration of reference standard lamp for lamps or ballast factory.

Repair and calibration of illumination meters (lux or footcandle meter).

Provision of glass blowing facility for repair and reproduction of technical glass wares.

Testing Jobs

They are taking a large number of testing jobs for state agencies and private enterprises. These include:

Testing according to Thai Industrial Standard Institute (TISI) standards of incandescent lamp, fluorescent lamp, ballast for flourescent lamp and other electric appliances.

Mechanical testing of construction materials and industrial products conforming to the TISI standards such as, wrought and cast steel products cold-reduced tinplate and cold-reduced blackplate, hacksaw blades, rigid cellular plastics, chalk, gypsum board, clips, paper, wire, wall tile, floor tile, mosaic tile, vitreous china and earth ware, sanitary appliances, toilet tissue, facial tissue, table napkins, ordinary sheet glass, automotive safety glasses etc.

To provide the chemical analysis of natural and agricultural products such as minerals, metals, alloys, food in cans, flour and beans, milk, vegetable oils, fat pulp, chemical compounds, soil, fertilizer etc.

Nondestructive Testing (NDT) facilities

The TISTR does not have much to offer in the area of nondestructive testing at the moment. In the area of ultrasonic NDT, they have only a wall thickness meter. Even the very common and essential equipment 'Ultrasonic Flaw detector' is yet to be procured. Dr Nandhasri arranged a meeting of his senior colleagues with the delegate in which various aspects and the basic requirements of an NDT laboratory were discussed and explained to them.

Dr Nandhasri also expressed a desire to get one or two of his scientists trained at NPL and other institutions in India.

CANADIAN CONGRESS OF BIOLOGY : A REPORT*

Dr S N Singh, attended the Canadian Congress of Biology which was held in the University of Western Ontario, London, Canada, from June 23-29, 1985. The official academic inauguration of the Congress was done on June 24th by Professor A K Adlington, acting President and Vice-Chancellor of the University of Western Ontario. The prominent speakers at the Congress were Dr J R Nursal, Dr D F Mettrict, Dr G Machlachlan, Dr Burr Atkinson, Dr M L Pardue, Dr J Key, Dr E L Medzon, Dr M R Rose, Dr J Thompson and Dr S Goldstein. There were parallel academic sessions of different Canadian Societies which included: Canadian Botanical Association, Canadian Society of Microbiologists, Canadian Phytopathological Society, Canadian Society of Zoologists, Entomological Society of Canada and Genetic Society of Canada.

The first plenary lecture was given by Dr J R Nursal, President, Biological Council of Canada, highlighting the various aspects of biological researches done in Canada. He emphasized the need for research work in the applied aspects which should be funded by the federal governments. Dr D F Mettrict of Toronto presented an overview of the modern approach to the research activities in respect to plant, animal and related science. Dr G Maclachlan of Montreal spoke on 'Bio-Enterprise in Canada' with special reference to Biotechnology and the other areas in which research activities could be initiated.

A symposium on 'Gene Regulation by Environmental Stresses' included a talk by Dr M L Pardue of MIT, Boston, USA on 'Heat-shock and stress response in *Drosophila*. She presented data showing that translational efforts of the cell are concentrated on the production of the heat-shock proteins (hsp's) which are encoded by the heat shock induced mRNAs. Removal of the stress allows recovery from heat shock and resumption of normal cellular metabolism. Thus, the heat shock offers an easily manipulated model system to study molecular mechanisms of gene expression. Heat shock response is also of interest because it appears to be highly conserved homeostatic mechanism.

Dr John J Haikkila of Waterloo University presented his findings on 'Products of stress and heat shock genes in animals'. He showed that elevation of the incubation temperature (20-24°C) or exposure to metal ions (Cd and Zn) induced a set of

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*Based on the delegation report of Dr S N Singh, Reader, Department of Zoology, Banaras Hindu University, Varanasi, UP.

heat shock proteins (hsps) in salmon embryo cells. The ability of the embryo to undergo a heat shock response (synthesis of hsps) was correlated with the ability to detect hsps mRNA accumulation by either *in vitro* translation or Northern hybridization assays. Thus, the stage-dependent synthesis of hsps in *Xenopus laevis* may be controlled at the transcriptional level.

Dr J Key of Colarado, USA, talked about 'Stress genes and their products'. He has been able to isolate heat shock proteins from Soyabean. Dr Burr Atkinson presented a paper on 'Characterization and functional aspects of the heat shock and chemical stress response in circulating (*in vivo*) and cultured (*in vitro*) blood cells from birds and mammals' and concluded that blood cells maintained in culture, in response to a variety of chemical stressors (ethanol, arsenite etc.), synthesize proteins. The blood cells of hyperthermic birds and mammals synthesize proteins identical to hsps.

A full morning session was devoted on 'Aging : 'From Cells to Organism'. Dr S Goldstein from Arkansas, USA gave his talk on 'Cultured human fibroblasts change, their genetic organization and expression' during replicative senescence emphasizing that specific alterations in genetic organization and expression may be involved in the mechanism that regulates cellular aging and in the origin of age-dependent diseases such as cancer.

Dr J E Thompson presented data on senescence in plants and showed that senescing thylakoid membrane produce increased levels of superoxide radicals. The increase in free radical production during chloroplast senescence correlates with a decline in photosynthetic electron transport. Dr M R Scewczuk presented his findings regarding 'Aging and the immune response'. The data reveals that the idiotypic repertoires expressed by systemic and mucosal immune cells of aged mice are different and non-overlapping. Primary immune response of various aged C 57BL/6J mice to trinitrophenylated gammaglobulins (TNP-BGG) results in reduced plaque forming cells (PFC) in systemic areas of old mice. Michael R Rose gave a talk on 'The cause of senescence in *Drosophila*' based mainly on the hypothesis that the cause of senescence in *Drosophila* is the declining force of matural selection with age and in its action in age-specific components of fitness. These components of fitness are age-specific survival probabilities and age-specific fertilities. The experimental findings indicate that there may be relatively few genes of major effect which determine the rate of senescence.

A free paper session on 'Metabolism' included the paper presented by this delegate on 'Effect of methylxanthines on rat liver glutamate dehydrogenase as a function of age'. The presentation highlighted the *in vitro* effect of methylxanthines (caffiene and theophylline) on crystalline liver GDH from the young (22-weeks) and old (116 weeks) female rats. Both, caffiene and theophylline inhibited shows differential pattern in the reverse and forward direction of the enzyme reaction. The inhibitory

constant (Ki) of caffiene and theophylline and the type of inhibition varies with the specific substrate or coenzymes used.

A paper entitled 'Effects of exposure to lead, cadmium and mercury on the tissue of young fish and rats' was presented by Dr D M Nicholls. He reported that the response of the kidney and liver, both in mammals and fish exposed to cadmium and mercury involves the stimulation of transcription of the genes to provide messenger RNA (mRNA) for metallothionein species. The mRNA obtained from the muscles of rate given Pb^{++} alone, Cd^{++} alone or $Pb^{++}+Cd^{++}$, all showed increased for a glycolytic enzyme glyceraldehyde-3-phosphate dehydrogenase. In fish, this enzyme exhibited altered activity.

The finds relating the effects of urea and trimethylamine oxide (TMAO) in mitochondria isolated from Elasmobranch and teleost liver was presented by Dr St Andrews. He reported that the respiratory control ratio (RCR) of skates and flounder liver mitochondria have similar osmotic optima in a sucrose-KCl or TMAO supplemented medium. But the addition of urea to sucrose-KCl medium extends the osmotic optimum. However, addition of urea to TMAO (2:1) does not improve the RCR of the respiration.

Dr G D Foster convincingly showed that glucagen increases the production of glucose (4-fold) whereas insulin has no effect in the isolated hepatocytes of the Sea-Raven (*Hemitripterus americanus*). Insulin stimulates serine conversion to all end products while glucogen increases conversion only to protein and glucose. Glucogen alters low and high substrate activities of BFK, PK and PEP-CK, but insulin had no effect.

The congress ended with an announcement to meet again in Toronto to have an overview of biological researches in the respective societies.

INTERNATIONAL LENS DESIGN CONFERENCE : A REPORT*

The International Lens Design Conference was held June 10-13 on during 1985 at Cherry Hill, New Jersey as part of the 1985 Spring Conference on Applied Optics, continuing the series of the Optical Society of America/SPIE -the International Society for Optical Engineering co-sponsored Lens design meetings that included Mills College (1980), Haverford College (1975) and Rochester (1966). About 500 delegates participated in this conference, out of whom approximately 360 were lens designers, the rest were connected with fabrication and testing of optics. Scientists and workers in Optics from nineteen countries presented eighty two technical papers spread over sixteen technical session spanning over three and a half days. During the conference, besides technical sessions, computer sessions and industrial exhibitions were held. Also a quiz session was held in which reversible lens design problem solutions were presented and discussed. The delegate presented two papers, one on 'Four element opto-mechanical varifocal (zoom) systems' and the second on 'Satellite camera lenses for earthr esources survey'.

In the literature, opto-mechanical compensation zoom lens is billed to be the upto date and credited to be advantageous over optically and mechanically compensated zoom systems. In the presented article it is proved that Bergestein's four element optical design interation procedure is not flexible leading to unique solution, hence an alternate, simple flexible procedure has been suggested to cover varied applications like broadcasting television zoom systems, closed circuit television zoom systems for general photography etc. Further, it has been proved that the methods suggested after Bergestein are the special cases of the suggested procedure. Space camera lens systems are to be diffraction limited-performance-wise, as they have to record images of terrestrial objects of varying chroninance and luminance at distances varying hundreds to thousands of kilometers. Thus, in the space camera systems the optical aberrations are to be eliminated totally, whereas in ordinary optical designs it is suffice to balance the aberrations with appropriate residuals. In the article, it is proved that from basic configurations without using field flatner, long focal length diffraction limited space camera systems for low, medium and high resolution can be designed. This is in comparison with the complex, multi-element systems with field flateners designed by Itek, JPL developed for NASA. It is essential to conceive simple congfiurations with minium

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Based on the delegation report of Dr E K Murthy, Scientist-in-Charge, Electro-Optical System Design Division, Central Scientific Instruments Organization, Sector-30, Chandigarh-160 020.

number of elements because complexity to realize perfect hardware increases (non-linerily) exponentially with increase in elements of the configuration. Besides this article, the capabilities of various types of simple configurations were explained, and a new class of simple constructions with alternate positive and negative elements were demonstrated (which are not found in literature) to cover wide specifications effectively.

Major Breakthroughs/Results reported at the Conference

Unfortunately, like most of the other problems in science, exact relationships between optical system configuration parameters (N) and the total number of image displacements (aberrations) M are unknown. Some of the *rms* aberrations of the optical system over the entire aperture, field and spectrum is termed as defect function value ϕ which the designertries to reduce to the desired value in the system. In this connection, various methods, such as variable-by-variable, steepest descent, least squares principle etc. have been tried. For most of the constructions $N < M$ and a unique solution is not possible at one stroke. Hence iterations are inevitable to control ϕ. Out of all the methods least square technique is most commonly used by considering the first order differential equations of $M \times N$ order by forming a matrix D, i.e. liner relationships are assumed between system parameters changes and the corresponding changes in aberrations.

In most of the systems matrix D is very close to singularity depending upon the specifications and construction choosen. The transpose of D.D', which one comes across in obtaining least square solution, is much more close to singularity with a large spread in the magnitudes of its eigen values. It may result to yield a solution worse than the previous one which one calls it as due to ill conditioning.

The design process of optical systems are plaqued with two major problems of non-linearity and ill-conditioning which could have been avoided if the computer had infinite speed and accuracy. These two problems are solved partially through damping procedure and human intervention. Thus, most of the optical designers solve their design problems through damped least square method, though Professor Grey (USA, GENII. Pc.) uses orthonomalization technique to find solution. The bright spot on this scene is that the lens designing community is channelizing all its resources and energies to create environment and condition and to develop computer software replacing the human intervention at crucial stages by creating an "artificial intelligence". This can be achieved if and only computer hardware gears itself to match with the software development by attaining infinite accuracy and speed. This in turn facilitates design and development of optical configurations with less and less human intervention. The work on hardware and software is in progress throughout the world in this regard.

Another interesting and healthy feature reported at the conference is regarding the feedback from the industry to personnel in R and D and academia. This creates

a bridge between consumer and scientist, in better understanding of needs of the public and limitations of development process necessitating the reorientation of strategies and channelizing the resources to cater the needs of the world leading towards an optical utopia.

Recommendations/Conclusions arrived at the Conference

The conference arrived at the conclusion that in recent past, progress has been made in several areas affecting design. New systematic approaches to the design process are being proposed to meet the present and future demands. Technologies, such as, the use of aspherics and gradient index materials are now available to the designer, requiring new and creative approaches to optical system design. And with this upsurge in modern optics and its impact on present and furture industry, design and development process, opticals designers and engineers have a larger, effective and well defined role to play. This calls for disciplined and a systematic approach to the configuration problems and industry requirements. In view of the prevailing situation, the scientific consiglirie assembled at the conference recommended upon :

i) the pursuit of perfect designs needed for new emerging fields for both fixed and zoom systems and their potential in various new emerging applications.

ii) Proper accordance of views of the manufactures and industry regarding consumption patterns and their implementation for design and development strategies.

iii) Updating of old exisiting designs in view of sophisticated and standard computer software available (for design and evaluation) and latest production and testing techniques, in order to economise on costs and improving on design, production, testing and evaluation techniques.

iv) A new radical approach to develop artificial lens design programmes with or without minimum human intervention. The programme should reflect the whole experience and skills of entire design teams to facilitate the future demands in near real time intervals.

v) Utility of plastic optics for low resolution optics. such as, copiers, video projection, laser printers etc., and combination of these with optical glass elements to serve medium and high resolution for future demands.

INTERNATIONAL CONFERENCE ON BIOLOGICALLY INDUCED CORROSION : A REPORT*

The first international conference on Biologically Induced Corrosion was held at Gaithersburg, Washington DC, from June 10-12, 1985. About 250 scientis ts,engineers and people from various industries attended the conference. This was organized by National Association of Corrosion Engineers, USA and by National Bureau of Standards, USA. The conference was inaugurated by Dr R G Kammer, Deputy Director of National Bureau of Standards who gave the welcome address. After the opening remarks given by the conference Chairman Dr S C Dexter, the discussion was carried out in four sessions. The morning session, was devoted to the Historical Perspective and Current Problems. The first lecture was given by Professor R Starkey of Rudgers University on perspectives about causes of anaerobic corrosion. He discussed the contributing corrosion factors, like sulphide, iron-sulfides, oxygen concentration cells and $FeSO_4$ etc. A review of the European research effort of microbial corrosion was made by A K Tiller of NPL, UK. Dr D H Pope, of Rensselaer Polytechnic Institute, New York also presented a review of microbiologically influenced corrosion.

The second morning session was devoted to the discussion about some case histories. Dr G Kobrin of Du. point Company, USA presented some cases of biologically influenced corrosion of stainless steels. Biological and corrosion activities of sulfate reducing bacteria in industrial process plants were discussed by W A Hamilton of University of Aberdeen. He also discussed corrosion activities of such bacteria within natural biofilm with the help of S^{35} radioespirometric method. Microbiological tuberculation of Aluminium particularly pitting corrosion was discussed by C R Schmitt of Bechtel National Inc.

Corrosion behavior of ductile and grey iorn pipes in environments containing sulphate reducing bacteria and also corrosion of sub-sea pipe lines were discussed by R A King of Manchester, England. Localised corrosion behaviour in underground brass pipes of low Zn content (91.6% Cu, 8.22% Zn) was also discussed by C Valentini of Argentina. G Eidse of Norway presented preliminary results on the investigation of SRB and corrosion of offshore structure particularly micro and macro-fouling on platform structures.

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* Based on the delegation report of C R Das, Department of Chemistry, Ravenshaw College, Cuttack, Orissa.

Biological corrosion due to some marine algae, from Chilka lake in Orissa was discussed by C R Das from India. Corrosion ofva rious types of welded mild steel and 304 stainless steel samples has been studied in three species of green-blue and red marine algae like *Nostoc parmelioides* Kuetz. ex Born et Flash, *Anabaena sphaerica* Bornet at Flahault, and red algae like *Graciollasia* in Bay of Bengal Coast, India. The rate of corrosion has been studied by X-ray diffraction and by scanning electron microscopic methods. The corrosion mechanism has been discussed in relation to the bacteria present in 'Aufwucks' formed and other bio-chemical degradation of the algae.

After the presentation of the research paper, interesting discussions were held about the mechanism of such a corrossion damage. Since the above work was conducted in-situ, therefore, it was opined that the results would help to find out suitable methods of protecting the steel structures, used particularly for naval applications in marine environments. The interesting results obtained for cold rolled and hot rolled welded steel specimens, drew the attention of other research workers in the field.

In the second day of the conference, various mechanisms were discussed in four sessions. Since laboratory experiments, carried out to study biological corrosion failed to reproduce the same type of corrosion damage which is obtained in-situ, therefore, D J Duquette of Renselaer Polytechnic, New York discussed the fissibility of developing electro-chemical methods, to study the mechanism by initiating or enhancing corrosion reaction in laboratory conditions after creating the same environment as exists in field operation.

Biological corrosion activities of SRB within natural biofilms, in-situ conditions were discussed by W Hamilton of Aberdin. The roll of marine bacteria in crevice corrosion initiation was discussed by S C Dexter. A machanism for the corrosion of mild steel induced by SRB, with the help of potentiostatic technic was discussed by Videla of Argentina. The role of phosphorous and H_2S in the aerobic corrosion of iron and it's possible detection by electro-chemical noise technique was discussed by W Iyerson of NSB, Washington, DC. The role of SRB on the localised corrosion of burried pipes was discussed by K Kasadhara of Tokyo Gas Co., Japan. He indicated that the activity of the SRB in the vicinity of anodic site plays a vital role in the corrosion process. Surface stimulated increases in hydrogenase production by sulfate reducing bacteria. The consequences in corrosion, in presence of anaerobic SRB were discussed by E Williams of NAC, Canada. The implications of the hydrogenase over production to the mechanisms advanced to explain the corrosion induced by SRB were also discussed by him.

Corrosion by iron-reducing bacteria isolated from oil-producing systems in Western Canada, was discussed by C O Obuekwe from Nigeria. Microbial activity within biofilm on metal surfaces can influence hydrogen uptake and embrittlement of

some materials. Two experimental approaches were discussed by R Mitchel of Harvard University. A quantitative investigation of three mechanisms for microbial corrosion, by measuring the magnitude of current resulting from the Colonization of Ni 201 disc by thermophilic bacteria was discussed by P Wagner of NORDA.

The majority of bacteria grow in adherent biofilms on available submerged surfaces. The microbial ecology of surface colonization and of consequent corrosion was discussed by J W Costerton of Alberta, Canada. Corrosion of steels induced by aerobic bacteria and their exocellular polymers, was discussed by D C White of Florida, USA. He gave an insight in to the mechanism of microbially induced corrosion, particularly the inhibition by biomass, community structure and metabolic activity, of the mirobes and their extracellular products.

On the final day of the conference, various experimental methods were discussed in three sessions. Experimental methods for the study of biocorrosion and the use of biologically active environments for testing the corrosion fatigue properties of offshore structures, were discussed by R Tatnall and C Thomas of Delaware, USA and Sheffield, UK respectively. Internal and external biological corrosion of sub-sea pipe lines were discussed by R A King of Manchester.

Evaluation of methods for the detection of microorganisms involved in Microbiologically influenced corrosion, was discussed by D H Pope. He discussed several techniques, which can be used to inexpensively and rapidly detect organisms involved in MIC like utilizing primary antibodies, secondary antibodies chemically linked to biotin, and fluorescently labelled Avidin etc. Activity of SRB on metal surfaces in an oilfield situation and also of reinforced concrete, were discussed by S Maxwel of Scotland and R A King of Manchester, UK, respectively. Development of an alternative method for studying the role of H_2—consuming bacteria in the anaerobic oxidation of iron was discussed by R Mitchell of Harvard University.

The final session was devoted to various remedial measures for biological corrosion. The effect of radiation on microbes and it's use in controlling microbial corrosion was discussed by M R Telander of Richland, USA. The cathodic protection techniques used to prevent bacterial corrosion in line pipes was discussed by T R Jack of Canada. An overview of the protection methods of burried structures, material selection and hydro—test procedures used to minimize the microbial corrosion damage, was presented by J Stoacker of St Louis, USA.

After the discussions on various research papers presented from various parts of the World, it was decided to work on the mechanism of biologically induced corrosion: to find out if sulphur reducing or iron-reducing bacteria or various algae, really effect the corrosion process and whether they accelerate the processor retard the process. Efforts to be made to know how the microorganisms affect the metal

substrate. The probable electro-chemical mechanism of formation of biofilms also should be investigated. All sorts of environments like burried pipes in marine conditions, reinforcement concrete in oil-field situations, etc, are to be considered. After that suitable methods of prevention are to be found out.

In India, at the coastal belt, particularly in Bay of Bengal Coast, there are naval bases of Indian Navy. Various metallic structures, particularly naval ships, and oil platforms are seriously damaged by localised corrosion, and crevice corrosion. This process is very much accelerated by the presence of various algae and other micro-organisms, like greenblue and red algae, present in plenty in the coast site. Therefore, research in the field of biologically induced corrosion in the marine environment in India is absolutely necessary to find out suitable methods to prevent microbiological damage. From the discussion held by various participants in the International Conference, it was revealed that, in Indian ocean extensive multidisciplinary research is to be carried out, to find out the real mechanism of a biological corrosion and then to find out the future requirements of corrosion engineering in the field and to identity and control these problems.

INTERSOL 85 : A REPORT*

INTERSOL—85 is one of the biennial congress of the International Solar Energy Society which was attended by over 500 delegates from more than 50 countries. The main theme of the conference was 'Solar Energy : The Diverse Solution'. In all, seventy sessions were held which included 51 technical paper and 19 workshop sessions. The total number of papers presented in these sessions was about 550. Following were the topics covered by the conference : (a) Active and passive heating and cooling of buildings; (b) Industrial, commercial and agricultural process heat; (c) Solar thermal power; (d) Photovoltaics; (e) Biomass; (f) Chemical conversion and storage; (g) Wind systems; (viii) Economics and policy and (e) Resources. The maximum number of papers, however, where presented on 'Active and Passive Heating and Cooling of Buildings'. It can be remarked about the conference that it provided a broad and practical forum for the exchange and dissemination of upto-date information in the field of solar energy.

The delegate presented a paper entitled *An Air-Hearting System for Solar Drying of Cereal Grains.* The proposed system uses ground as the collector/storage medium for air-heating purposes. It consists of a metallic duct burried in the ground. The air which flows through the duct, retrieves heat from the surrounding medium. The paper attracted a lot of attention from the delegates. The proposed system has great potential for the use in real field conditions, especially in the developing countries, because : (a) the technology is simple and can be used even by the unskilled farmers, and (b) it is a low-cost system.

Technical merits of the system include the following :

a) Storage of heat is sufficient for its continuous operation during day and night; this is essential because the harvesting season is usually small.

b) A rise of the order of 8-10°C in the average air-temperature can be obtained which is suitable for cereal grain drying.

Major Breakthrough/Results reported at the Conference

Results of various research and development activities in the field of renewable energy resources were reported during the conference, however, the following need special mention :

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*Based on the delegation report of Dr Ashvini Kumar, Centre of Energy Studies, IIT, Hauz Khas, New Delhi-110 016.

(a) Results of the International Energy Agency suggest that the solar heating plants with seasonal storage using heat-pumps provide the lowest cost of unit solar energy.

(b) Selective surface Trombe walls perform better than the uninsulated Trombe wall; however, when compared with Trombe walls using night insulation, the difference in the performance is very small. (B of Chen and Colleques, University of Nebraska, USA).

(c) A hybrid solar cooker which uses electricity as the supplementary power source on the days of uncertain sunshine hours can increase the number of days at least by 15% for which the solar cooker is used in the countries having a tropical climate. The important feature of the developed solar cooker is the automatic selection of the level of auxiliary energy required which is the function of the available insolation. This solar cooker can also be operated unattended without spoiling the cooking products (B L Panchal and J N Desai, PRL, Ahmedabad).

(d) The studies by National Research Council of Canada have indicated that the U-value of the windows can be improved from 2.88 W/m^2 K (conventional double-glazed window) to 1.21 W/m^2 K (double-glazed window with aerogol). (S A Barakat, NRC, Ottawa, Canada).

(e) It is necessary to take into account the effect of infra-red exchanges between the walls in the computer simulation programs used to predict the thermal performance of the houses. (J C Bellouvet and Colleques, Universite Paul Sabatier, France).

(f) A reduction in the mass flow-rate in the collector loop results in the reduction (5-10%) on the use of auxiliary energy. (A H Fanney and W A Klein, USA)

(g) The studies carried out for the development and optimization of the systems equipped with evacated tubular collectors showed that the efficiencies of the order of 50% at an temperature of 60°C (efficiency based on aperture area) can be obtained with these systems. Also, east-west orientation resulted in the higher efficiencies (E L C deVaan, the Netherlands).

(h) Hybrid desiccant systems can reduce air-conditioning energy costs from 50% to 70%. However, the solar collectors with no storage further reduce the requirements of the auxiliary energy by an additional 50%. (P R Burns and Collegues University of Wisconsin, Madison, USA).

(i) The air-heating system utilizing the storage potential of the ground can provide air-temperatures of the order of 8-10°C higher than the ambient-air-temperature

which is appropriate for cereal-grain drying. These systems are low-cost systems and can be used even by less-skilled persons. (A kumar and collegues, IIT Delhi, India).

(j) Without changing basic operation, a non-convective solar pond can be used for the electrical energy production and its storage by the application of electro-chemical phenomenon in it. It has been reported that the process is advantageous because:

a) it is cost-effective;

b) high discharge current densities can be achievd;

c) there is no critical discharge level. At 10% charge level, open circuit voltage is 80% of its value at full charge. (J Doria and Collegues, Spain).

(k) Feasibility studies carried out for Queensland (Australia) solar pond indicate that 28/KWh is possible for a salt cost of $ 20/tonne. (L Qzakcay and H Gur-genci, Australia).

(l) A crossed lens photovoltaic concentrator offers substantial mass-production cost savings (at least $ 1 per peak watt due to silicon cell area reduction) in comparison to a Fresnel lens collector; this also provides a peak conversion efficiency of 15.5%.

Recommendations/Conclusions arrived at the Conference

Various solar energy devices have been in existence for many decades and subjected to much development. Improvements in the performance of these systems, therefore, tend to be in the nature of engineering changes aimed at increasing efficiency or improving the economics of manufacturing or application. Despite the maturity of the technology, there is still substantial scope of improvement in the performance and cost of these systems. It was recommended that the ongoing research and development activities aimed at making the solar devices competitive with the conventional devices in terms of economics and ease should be further encouraged. In this reference, following areas need special mention :

(i) Photovoltaic

(ii) Enacuated ! Tubular Solar Collectors

(iii) Multi-crop Solar Dryers

(iv) Energy storage

(v) Wind Energy Conversion Systems

(vi) Biomass.

It was also concluded that the gap between the passive and active systems should be narrowed down. This, in turn, means that the hybrid system (solar+conventional) approach should be adopted which seems to be more economical.

It was concluded that reliable scientific data is now available which confirms the emergence of thermo-electric conversion. Economic assessments, which are still incomplete, are hindered by the prototype nature of the installations. The scale effects which began with the design and construction of commercial plants are encouraging; these must be made specific and validated for other plants.

Amorphous silicon has high absorption coefficient for visible light and therefore, acts as a good solar heat absorber element. Other advantage of amorphous silicon as a solar cell material is that is a low cost material. Recent progress in the field of amorphous silicon solar cells and their technologies in Japan has been satisfactory; this has resulted in the development of some new approaches to improve photovoltaic performances utilizing the optical and carrier confinement effects with new amorphous materials such as amorphous SiG, SiGe and micro-crystalline Si.

Bioconversion, as concluded, is an integral part of the industrial and economic development. It was recommended that the agricultural organizations ranging from individual farmers to giant corporations need a wider diversity of crops to grow. The academic community needs to be brought into the new crop development programs in a constructive way, as must the end-using industries. It was further emphasized that the local, state, national and worldwide environmental protection activities need to be integrated with crop production and industrial utilization. Also, the integration of waste water treatment with energy production should have high priority.

It was emphasized that the knowledge of extensive and precise solar radiation data in their appropriate form is of fundamental importance for the future of solar energy developments and applications. It was recommended that the programmes with the aim of producing more and more data in the form easily accessible to the users should be initiated. The development of standards, manuals, guidelines, and effective data management are all necessary steps in attaining our energy goals.

India being a developing country needs to have an emphasis on the development of the renewable energy technologies so as to meet the increased demand of energy for its various developmental activities. INTERSOL – 85 provided the best possible opportunity to the participating Indian delegates to exchange their view on the topics of mutual interest with the internationally recognized experts in the field.

SHORT COMMUNICATIONS

DR B SINGH, Department of Chemistry, Faculty of Science, Banaras Hindu University, Varanasi attended the SECOND EUCHEM CONFERENCE ON THE ELECTRONIC STRUCTURES OF TRANSITION METAL COMPLEXES at St. Patrick's College, Maynooth, Ireland from March 31-April 3, 1985. First EUCHEM Conference on the 'Electronic Structures of Transition Metal Complexes' was held in 1978 at St. Patrick's College, Maynooth, Ireland. Since then there is large report on the research in this area. The primary aim of the Second EUCHEM Conference on the 'Electronic Structures of Transition Metal Complexes' was to bring together theoreticians and experimentalists to review the application of theoretical methods in general area of cordination chemistry and organometallic chemistry. Twenty-six experimental and theoretical papers were presented in oral and poster sessions. These papers covered the area such as electronic structure calculations, transient species, photoelectron and electronic spectroscopy, structure and reactivity correlations and structural problems. The conference was inaugurated by Professor D A Brown, Department of Chemistry, University College, Dublin, Ireland. The paper entitled 'Magnetic and spectral studies on complexes of Schiff's bases derived from 2-furoyl hydrazine', was presented by the delegate. The paper concerned with the first row transition metal complexes of Schiff's bases derived from reaction of 2-furoylhydrazine with *o*-hydroxy-actophenone, 2-acetylpridine and 2-acetylfuran and their characterization by magnetic and spectroscopic (IR. visible and ESR) measurements. The stereochemistry and bonding of the complexes elucidated from these studies were discussed at the session by the theoreticians and the experimentalists. ESR studies have been used to indicate the ground state which is occupied by the unpaired electron and monomeric/dimeric nature of the complexes.

The conference ended with a general remark that there should be exchange of ideas between the theoreticians and the experimentalists engaged in the problems related to the electronic structures of the transition metal complexes. Since the experimental coordination chemists propose the structure based on the experimental data obtained from spectroscopic, magnetic and other analytical techniques. These data can be more successfully interpreted in terms of the theoretical results. There was strong opinion that more work should be done in the theoretical field in the promotion and understanding of coordination chemistry.

The first lecture was delivered on 'The role of virtual orbitals in the physical and chemical properties of organometallic complexes' by Professor Richard F Fenske,

Department of Chemistry, University of Wisconsin-Madison, Medison, USA. He discussed the applications of approximate molecular orbital methods to organometallic systems with emphasis on correlation of the eigen values and eigen vectors of the occupied orbitals with the physical properties of the molecules. He described the characteristics which involved the virtual (unoccupied) molecular orbitals and some of the applications including carbon-13 NMR chemical shifts and the sites of nucleophilic and electrophilic attack by considering the examples such as $C_PFe(PH_3)_2$ × and C_PRe (No) (Co) (PH_4) + and related species. He also discussed some precautions in terms of choice of basis sets and substitution of smaller constituents in order to simplify the calculations. Professor D R Lloyed, Chemistry Department, Trinity College, Dublin in his lecture proposed the mode of coordination of pyrlidine to metal surfaces in his research work and proved it on the basis of photoelectron spectral studies of pyridine coordinated to copper surfaces. Professor J J Turner, Department of Chemistry, University of Nottingham, UK delivered a talk on 'Organometallic fragments and Transients'. He discussed the importance of coordinatively unsaturated and often very reactive species-'transients' underlying of the electronic structure and properties of complex transitions metal species. He discussed the results of organometallic fragments and transients usually metal/CO species by three related techniques matrix isolation, liquid noble gases as solvents and time-resolved IR spectroscopy.

PROFESSOR C L KHETRAPAL, Indian Insitute of Science, Bangalore attended the GORDAN RESEARCH CONFERENCE ON MAGNETIC RESONANCE at. Wolfebord, New Hampshire, USA from June 17-21, 1985. The Gordon Research Conferences are prestigious scientific meetings where participation in only by invitation. Professor C L Khetrapal was invited from India for the Conference on Magnetic Resonance. The conference was attended by 120 scientists from countries like USA, France, Germany, Switzerland, Canada, Netherland, Australia, England, Finland, Belgium, Italy, Poland and Greece. Conventionally the lectures are held during morning and after dinner everyday—the afternoons being free for discussions among the individual scientists. In about 40 scientific presentations, various aspects of magnetic resonance from techniques to applications were covered. Some of the interesting areas covered are : NMR studies of molecules absorbed on dispersed metals, a novel technique for characterisation of transient redicals, NMR of asymmetric motion in liquid crystals, studies in mixed nematic-nematic and nematic-cholesteric liquid crystals, NMR of orientational order to diatomic molecules in to 2-dimensions, NMR studies of thin film semiconductors and time domain electron magnetic resonance to mention a few. A very interesting and informative lecture was given by Professor Abraham from France on 'A Few Text Book Experiments : A look in the Rearview Mirror'. It covered some interesting discoveries of NMR and the future of magnetic resonance in a critical and authoritative manner. The area of biological applications of magnetic resonance was also covered. A novel fractal model of electron spin relaxation in biopolymers was presented.

There was considerable discussion on the paper presented by Professor W Doane, Director, Liquid Crystal Institute, Kent State University, Kent Ohio, whereby he presented the unusual result of the observation of the order parameter larger than 1 or very large distortions in the molecular structure of phenylprotons. After a considerable discussion the problem was solved.

Professor Khetrapal presented the work on mixed nematic-nematic and nematic-cholesteric liquid crystals. The paper described novel results obtained by Khetrapal and his colleagues in Bangalore on mixed liquid crystals of opposite and similar diamagnetic anisotropies leading to new applications of NMR. In addition, it posed several problems for which the explanations are still not available and more research is required. A considerable discussion and interest was generated in this area.

PROFESSOR V SITAKARA RAO, IIT, Kharagpur attended the V INTERNATIONAL CONFERENCE ON SURFACE AND COLLOID SCIENCE at Clarkson University, Potsdam, New York from June 24-28, 1985. It was organised by Clarkson Institute of Colloid and Surface Science and was sponsored by (a) Division of Colloid and Surface Chemistry of the American Chemical Society; (b) International Association of Colloid and Interface Scientists and (c) International Union of Pure and Applied Chemistry. Over 1100 delegates from all over the world have registered for the conference and more than 600 papers were presented in a large numbers of sessions on varied and important topics like: Biocolloids, Computer Technolgy, Dispersions. Flocculation, Optics, Protein Adsorption, Nucleation, Mixed surfaces, Transport, Capillarity, Chemical Bonding, Gas Adsorption, Micelles, Micro-emulsions, Nonaqueous Systems, Natural Waters, Adsorption-Mono-layers, Emulsions, Macro-molecules, Poly Metals, and Surfactants. In honour of Professor Milton Kerket for his varied services to Clarkson University and also to the science of Colloids and surfaces, some special sessions have been conducted on "Colloid Optics and Spectro scopy". Another distinguished number of the same institute, Professor Hans Jellinek was also honoured by special sessions.

After the reopening ceremony of the conference Dr Ivar Giaever (Nobel Laureate in Physics in 1973) gave a plenary lecture on 'Cells and Proteins on Fluorocarbon—Water Interface'. After giving preliminary ideas of absorption of protein molecules from saline solutions on the fluoro-carbon oils, he gave two important applications of this work in bio-technology. One of them a micro carrier system, which can be used for mass culturing cells in tissue culture which will be very useful in cancer research. The second one is formation of an emulsion mirror, which can be used to serve as an immunological detector. Professor P G Gennes of College de France, Paris gave the second plenary lecture on the 'Dynamics of Wetting'. He stressed the role of spreading parameter, S, in wetting processes. A large value of S gives a better coverage and leads to faster spreading and explained various earlier theories on this basis.

The delegate presented two papers in the session "Chemical Bonding at the Gas-Solid Interface (II)" viz (a) Studies of kinetics of chemisorption on ceric oxide, and (b) Studies on the nature of iron hydrous oxide gel-Effect of temperature, pH, and cations.

Adsorption studies at low temperatures can be used to evaluate thermodynamical properties of substances. These studies on different types of solids reveal that I) nitrogen adsorption depends markedly on the chemical composition of the substrate below, within and beyond monolayer concentration and nitrogen adsorption on monolayers of oxide surfaces are site oriented over the periodic lattice potential. Studies on the nitrogen adsorption on solids can be used to gain an insight into the shape and size of the micro/and mesopores of the surfaces.

Different spectroscopic techniques used for the surface studies reveal that impurity adsorbate interactions at work in catalytic poisoning is fairly short ranged. Various experimental techniques like Differential Thermal Analysis, Thermo-gravimetric Analysis, Evolved Gas Analysis and Infra-red Spectroscopy can be used to study the phase changes that take place during the heating of the catalyst samples. It is also observed that correlations exist between pore size distribution, pore volume, surface area etc. and removal of water vapour or other gases from the surfaces during heating of the substances.

India is having rich resources of iron oxide, aluminium oxide and also manganese oxides. The oxides and oxyhydroxides of iron of are great industrial importance and find numerous applications in various fields such as pigments, catalysts, catalyst carriers, fillers coatings, fibres and abrasive grains. Magnetic materials based on iron oxide are also finding continuously increasing applications in audio and video instruments as well as in computers and whole range of microwave devices. These oxides are also extensively used for the preparation of various industrially important ferrites and for the photo-chemical conversion of water to hydrogen by solar energy. The micro structure and particular/grain size of these oxides play an important role in determining their extrinsic properties (and hence their different industrial uses). The different oxides and ferrites can be prepared using different newer techniques as suggested in the conferences. Surface areas, pore size distributions, adsorption of different gases and their kinetics can be studied and the possible industrial uses can be tried with all these substances.

DR BHASKAR DATTA, Biren Roy Trust Fellow, (Indian National Science Academy), Indian Institute of Astrophysics, Bangalore attended the INTERNATIONAL ASTRONOMICAL UNION SYMPOSIUM NO. 117 ON DARK MATTER IN THE UNIVERSE at Institute for Advanced Study, Princeton, New Jersey, USA from June 24-28, 1985. The basic theme at the conference was that a variety of observations

of different stellar systems definitely suggest that the material composition of our universe is dominated by dar (i. e. non-luminous) matter. J Bahcall (Princetion) presented observational evidence for dark matter based on dynamical measurements of the local mass density. In the solar neighbourhood, only half the mass could be accounted for by known objects. In larger scales his observations indicate evidence of dark matter haloes around individual galaxies. J Kormendy (Dominion Astrophysical Observatory) showed example of a very faint spiral galaxy which appears to have a dark halo. M Aaronson (Steward Observatory) presented new data on messes of dwarf spheroidal galaxies. Even the faintest of such objects indicate presence of dark matter. An important relevant question relates to the distribution of the dark matter. V Rubin (Carnegia Institution) suggested that the mass distribution can be very similar in galaxies having quite dissimilar morphological appearance. However, dark matter around alliptical and dwarf galaxies are difficult to detect (as there is no suitable dynamical tracers). According to K Freeman (Mt Strombo observatory) and R Sancisi (Groninggen), the observed rotation curves in a number of disk systems suggest that the dark matter and luminous matter distributions are not identical. M Davis (Berkeley) and J Ostriker (Princeton) presented arguments which suggest that total masses of group and clusters of galaxies is about ten times the masses of the galaxies they contain.

The question naturally arises next as to the composition of dark matter. This was summarized by M Raes (Cambridge) : plausible candidates for dark matter are (a) planet-like bodies, (b) massive black holes and (c) exotic forms of matter. He further suggested that if all galaxies are associated with as much dark matter as the galaxies in the clusters, then dark matter would be a tenth of the critical density for stopping the present expansion of the universe. A somewhat similar conclusion was inferred by J Audouze (Paris) from his studies of observed abundance of light elements in the standard model of cosmology. According to J Bahcall (Princeton), at least the local neighbourhood dark matter must be baryonic, that is hydrogen-like material. Infrared satellite observations offer the possibility of detecting planet-like objects. However, according to F Low (Steward observatory), there are no good candidates so for. Interestingly, limits on optical and infrared emission from dark haloes exclude any significant population of main-sequence stars (P van der Kruit, Leiden). Exotic dark matter candidates was summarised by M Turner (Chicago). These could be massive neutrinos, axions, supersymmetric partners of known elementary particles, quark suggests, shadow matter, etc. A few groups in the USA are now setting up experiments to detect these exotic particles.

In standard cosmological models, different elementary particle candidates for dark matter imply different predictions regarding the fluctuations in the microwave background and the morphology of the large scale galaxy distribution. In this connection, V Lukash (Moscow) presented new limits on microwave background radiation

anisotropies from the USSR RELIC Satellite. These data rule out the standard neutrino and baryon dominated cosmological models.

On the basis of general properties of the large scale structure of spacetime, the delegate presented new and general theoretical upper limits on the density of dark matter in the universe (assuming a 90% content for the dark matter) and lower limits on the mass of the axion, assuming the dark matter to be made up of axions. These limits are derived in terms of the possible lower limits to the age of the universe and the Hubble parameter. It is found that (for the age in the range (8-24) $\times$ 10^9 yr) the maximum density of dark matter is in the range (1.25 + 10 $^{:8}$ — 1.38 $\times$ 10^{-29}) g cm^{-3} and the minimum value of axion mass in the ranges (0.36-2.39) $\times$ 10^{-5} eV and (1.44-9.51) $\times$ 10^{-5} eV.

There were requests for the paper from research groups at California Instituth of Technology, Centre for Astrophysics, Harvard University and University of Rochester, USA. The following general conclusions were arrived at: (a) The existence of nonluminous matter in galaxies is definitely established from observational studies, and this probably constitutes about ninety per cent of the total material content of our universe; (b) The nature of this nonluminous matter is not made up of ordinary matter (such as protons, neutrons and electrons), but could be massive black holes, planet-like objects or exotic forms of matter.

DR S R PRABHAKARAN NAYAR, Lecturer, Department of physics, University of Kerala, Trivandrum attended the MICROSCIENCE CONFERENCE at Balaton, Hungary from 20-25 May, 1985. The workshop MICROSCIENCE was jointly sponsored by UNESCO and Roland Eotvos Society at Balaton lake side in Hungary during 20-25 May, 1985. The aim of the workshop was to present the trends, to exchange experiences and to discuss the problems related to the use of microcomputers (C) in Physics teaching. The workshop was mainly divided into two parts. The first part, the forenoon session, was a collection of invited talks on various aspects of the introduction of C in physics teaching and research, both in theoretical and experimental work. The afternoons were mainly spent on workshops with contributions from delegates demonstrations and practical training in various computer systems. For these, experimental set up were imported from various countries to Hungary by the delegates.

The inaugural paper, 'Computer Cultures' was presented by Professor Seymon Papert, MIT Laboratory of Artificial Intelligence. Professor Papert explained how computers could introduce and teach us the laws of physics. The second speaker, Professor Jos Beishuizen of the University of Amsterdam presented the world wide overview on the role of C in teaching and learning process. Dr Joseph Depireux of the University of Liege, Belgium explained how C can be used to help the low ability

students, especially students who are of low ability because of the language problem in a multilingual society.

Dr Gerard Y Vichniac of MIT Laboratory of computer science presented the famous cellular automation machine. Professor George Marx explained how the macroworld could be represented in microcomputer in the creative education. He also presented some of the computer softwares which he has developed for the Hungarian students. Professor Marx also explained how models could successfully be utilised in understanding the reality. Dr Jon Ogbon, University of London demonstrated his famous model of dynamic modelling.

Dr Dean Zollmann, Kansas State University, USA, presented the pupil-computer-video disc interaction and Dr Hans jorg Jodal of Kaiserlautern University explained how computer can be used to aid the presentation of video films. Dr Manfred Euler explained the nonlinear systems, self organisation and perception. He explained how different parts of the human ear respond to the acoustic waves.

Software's extention to the future textbooks was presented by Professor Peter Atkins of Lincoln College, UK. He discussed the impact of C in science curriculam. He presented a 3D coordinate system with axes power, purpose and language and narrated how various situations could be represented using these parameters. He also disscused the relative positions of teachers, computers algorithm and languages in this system. Professor Kunio Hirata of Yamanashi University, Tokyo explained the computer simulation of physical phenomena in his talk on 'Dry Laboratory'. He presented how graphical expressions can represent and simplify difficult mathematical ideas and useful in understanding laboratory experiments such as—scattering, reflection of waves, random phenomena etc. Professor J H Emck of the University of Technology Holland spoke on the use of computers in the laboratory, in achieving cheap, efficient, reliable, reproducable data gathering and controlling experiments.

Dr Hane Joachin Scholz of the University of Bremen, in his talk 'Computer Graphics and Fractal Structures' showed how the search for the convergence of a simple complex equation $Z_{n+1} = Z_n^2 + C$ can be utilised to build beuatiful pictures using computers. Professor Roman Sexl of the Vienna University presented the Einstein's world on C and computer graphics of the Lorentz contraction of relativistic cube, clock paradox, relative motion of car and the garrage etc.

There were parallel workshops in the afternoon on (1) Microphysics (2) Computers in the laboratory (3) Modelling (4) Microsound (5) How computers do (6) Statistics (7) Microbiology (8) Microchemistry (9) Micro and Scools and (10) Microgames. In the workshop on C in the laboratory, there were many demonstration experiments using C. They were diffraction pattern, coupled pendulam etc. In addition to these, 1D

Ising mode!, sky travel, particle in fields etc. These workshops were aimed at the familiarisation of various computer systems and softwares used in teaching physics. On the occasion of birth centenary of Niels Bohr, Professor Bric Rogers of Princeton University gave a special talk 'Reality, models, children'.

The physics department of the University of Kerala is engaged in project in developing a system software for data collection using C. The delegate could present a summary of the work being done on the on-line data collection in the workshop, computer in the laboratory. The workshop gave an opportunity to know about various systems used in the laboratory, techniques and methods of interfacing various accessories to them. Another advantage was knowing the softwares developed in various laboratories and also the professional software manufacturing firms which could be utilised in our project.

The workshop considered the rapid changes in the hardware and software of C and discussed the aspect of using the ready-made OY developed software. The learning and teaching of physics in many places were found to be simplified with the introduction of C in the teaching laboratory. The conference accepted the C software as the text book of the future, accepting the need for professional software and advised the extended use of C in schools. The other conclusions were (a) on opening new fields of study especially in nonlinear systems and chaos, (b) operation of the laboratory experiments in teaching physics, (c) bringing physics home and to improve the communication with the public. There were also recommendations in the extended use of Logo, computer games, dynamical modelling, spread sheets, interactive video discs, home movies, professional movies and public science. Professor Paul Black of the University of London organised these discussions. Professor Roman Sexl presented the recommendations of the conference.

The important points discussed in the workshop were on the introduction of C in some of experiments which could not be done in a laboratory. Some of the softwares presented especially those on Einstein's world supported this fact. Other fields are nonlinear systems and chaos. Even the creation of visual world can open up alternative topics and lead to the basic laws of nature.

Considering the Indian Scene, though we too have a large variety of C systems, we are far behind in the use of C in the teaching–learning process. Most of the countries either in the west or east have introduced C even in the school level and found that the teaching was found to be much simplified with the introduction of the C. The increased participation of students is another important aspect. Considering our country, there are two important advantages in the introduction of C in Science teaching. First one, which is of universal nature that students get involved in creative understanding and the basic laws of science could be made more clearer and simplar. They can do all experiments by simulating the situations even without well defined laboratory using

software programmes and graphics. The second aspect is very important for a multi-lingual country like ours, where the visual education has got an important role in science education. So the C can rise above the language barrier in the teaching process. The students can also be encouraged to improve the software according to their requirement. So the education of science will be in an entirely new region. One major problem facing here will be the compatibility between various C systems and softwares. This is a serious problem and one has to fix up some standards for this purpose. This job could be entrusted with some of our national bodies like NCERT or UGC.

DR U K CHATTERJEE, Department of Metallurgical Engineer, IIT, Kharagpur attended the IV ASIAN-PACIFIC CORROSION CONTROL CONFERENCE at Keio Plaza Hotel, Tokyo, Japan from 26-31 May, 1985. The Asian Pacific Corrosion Control is being held since 1979 every alternate year with a view to promoting exchange of knowledge and discussion relating to all aspects of corrosion control and meterials degradation with special attention to the problems in the Asian-Pacific region. The 1st APCCC was held at Singapore in 1979, followed by Kuala Lampur (2nd 1981) and Taipei (3rd, 1983) conferences. The 4th APCCC was held at Tokyo during May 26-31, 1985. The conference covered the following aspects of Corrosion and Corrosion Control spread over 15 sessions :

A. High Temperature Corrosion, Porosivity and Localised corrosion, Stress Corrosion Cracking and Hydrogen Embrittlement, Degradation by Mechanical Processes.

B. Atmospheric corrosion, Marine Corrosion, Corrosion in Power Generation Industries, Chemical and Petrochemical Industries, Buildings and Construction.

C. Coatings and Linings, Surface finishing, Corrosion Inhibitors, Cathodic Protection, Corrosion Testing and Monitoring, Corrosion Resistant Materials.

The three groups were run in parallel sessions. There were 10 keynote speeches spread over various sessions and 2 Plenary Lectures delivered at the inaugural sessions. The Plenary Lectures were on 'A battle against non-uniform corrosion', delivered by Dr H Okada, Managing Director of Nippon Steel Corporation and on 'Estimating the true cost of corrosion' delivered by Professor B W Cherry of Monash University, Australia.

Interesting works were presented on the prediction for pitting and crevice corrosion from the passivation behaviour. Other notable papers in the session on 'Passivity and Localised Corrosion' were on Localised corrosion properties of rapidly solidified aluminium alloys, Potential-pH diagrams for Fe-Cr-M ferritic stainless steels in chloride media and development of microcomputer system based on Moire method for penetration depth profiles on unevenly corroded metal surface.

A total of 17 papers were presented in the session on. Stress Corrosion Cracking and Hydeogen Embrittlement'. The principal thrust was on stainless steels and other ferrous alloys. The following papers were useful : Crack initiation and propagation behaviour of austenitic stainless steel in chloride environments, Applications of electrochemical potentiolimetic reactivation method for determination of senditization of weld metals, Use of laser mass spectrometer leak detector to study the hydrogen distribution in metals and monitoring of hydrogen content in line dipe steel.

In the field of Materials Development, the paper on Corrosion behaviour of amorphous alloys in boiling concentrated nitric acid opens a new direction. Improved corrosion resistance of stainless steels in chloride environments and of steels for atmospheric use through alloying additions was also highlighted in several papers. New developments were reported in the field of metallic coatings. Japanese experience in this regard is noteworthy.

The delegate presented a paper on 'Application of cathodic protection for systems corroding under splash zone conditions'. The paper dealt with the laboratory experimentation for simulation of the splash zone and its cathodic protection by maintaining a thin film of electrolyte on the structure. Although no field studies were made, the protection achieved in the laboratory was substantial (80%). The other contributions in this session principally dealt with the development and performance of aluminium anode, cathodic protection in sea water, potential decay on current interruption and design and development of deep anode systems.

Shri K P Mukherjee, Scientist, National Metallurgical Laboratory, Jamshedpur delivered the keynote speech in the session on 'Atmospheric Corrosion'. The title of his talk was 'Atmospheric corrosion : a current status on engineering metals'.

Both Shri Mukherjee and the delegate represented India in the committee meeting of the Asian-Pacific Materials and Corrosion Association, held on 29 May 1985. Among other matters, it also decided on the venue for the next APCCC. The V APCCC will be held in Melbourne, Australia sometime in 1987. Shri Mukherjee has been nominated an Executive member for the V APCCC.

DR K D BROOTA, Department of Psychology, University of Delhi attended the FIRST CIRCUM-MEDITEPRANEAN REGIONAL CONFERENCE ORGANISED BY THE INTERNATIONAL ASSOCIATION FOR CROSS-CULTURAL PSYCHOLOGY at the Malmo School of Education, Lund University, Malmo, Sweden, from 25-28 June, 1985. The purpose of the conference was to focus attention on the problems of Ethenic minority and immigration. Scientists from many continents and large number of countries were represented and wide range of topics were covered. The

programme consisted of invited lectures, symposia, and individual papers. The plenary lectures were : (i) 'Immigrants and ethnic minorities in Europe' by Jonas Widgren, Secretary of State for Migration Matters, Sweden; (ii) "Comparing the uncomparable: Cross-National Comparisons of 'Quality' in education' by Torsten Husen, Professor Emeritus, Founder of the Stockholm Institute of International Education and the International Evaluation of Education Association : (iii) 'Multiculturalism and psychology in plural socieities' by Professor John Berry, Queen's University, Kingston, Canada.

In the conference various aspects of the issues relating to the ethnic minorities and immigrants were undertaken. The research papers were equally varied that covered numerous problems in the said area. The problem areas included intergroup conflicts, reduction of negative attitudes, promotion of understanding, tension reduction between different groups. Some papers concentrated on the problems to identify development among migrants, problem of mental healh, educational programmes of migrants, stress and coping styles among migrants, problems of social support etc. Others were related to assimilation and preservation of minorities, problems of language, reduction of cultural conflicts etc., etc. The major objective was to discuss the meansby which people of different and conflicting nationalities could be taught to live together and adjust to each other in a particular country in mutual understanding and respect.

The delegate presented a paper entitled 'Religiousity and moral judgment development : A comparative study of minority communities in India'. The study has been carried out on three minority groups, i e Muslims, Christians, and Sikhs, and their responses compared with the majority Hindu group. The study was designed to investigate the relationship between religiosity and moral judgment development in the minority groups as compared to the majority group. It has been concluded that much of the social and the religious behavior of the minority communities could be attributed to the sense of insecurity emanating from their more powerful majority community. In order to counter the anxiety, as an outcome of insecurity, they develop a strong sense of separateness, an intense in-group unity, and on religious side strong affiliations and dogmatism. Further, there is a complex relationship between moral judgement development and the religious ideology of individuals. Strong religious affiiliations promote conventional morality and do not help the development of principles based on justice and equality.

Research on the various aspects of minority-majority relationship has assumed great importance in the present context of our national scene. It would be instructive to scientifically study the various problems in this context. Some of the important aspects of the problem could be to study the intergroup conflicts, prejudices, tension reduction among the minority groups, reduction of cultural conflicts, etc.

A Special Interest Group for Ethnic Minority and Immigration Issues (SIGEMI) met on 27 June 1985 to discuss the most important tasks to be undertaken by the

SIGEMI in the near future. The SIGEMI is a structure within the IACCP that helps in the promotion of research and other activities related to Ethnic and Immigration issues.

Dr M A RAMLU, Professor in Mining Engineering, & Deputy Director, Indian Institute of Technology, Kharagpur, attended the FOURTH SESSION OF THE INTERNATIONAL BUREAU OF MINING THERMOPHYSICS at Stanhope Bretby, UK, from 13-17 May, 1985. The Conference was held at the Mining Research Development Establishment (MRDE) of the National Coal Board, UK, at Stanhope Bretby. The delegate presented the state-of-art of the air-conditioning practices in the gold mines of the Kolar Gold Field, India. It was for the first time that such practices were brought to the attention of the international community of mining engineers. The systems of cooling small sections of the mines at very great depth by use of spot coolers and the surface and underground air-conditioning plants did not evoke any special questions during the question hour although the equipment is very much outdate. The major contribution came from the delegates of the East European block who presented their papers in their own languages which were simultaneously translated. It was apparent that in the western countries, excluding the Federal Republic of Germany, the subject had not attracted that much attention as in the East European countries.

The subject of the conference focusses the attention of the mine planners, equipment manufacturers and researchers on a more scientific approach to solution of the problems arising out of the worsening mine climates at great depths. Various theoretical and practical approaches to the solution of heat and humidity in mine working were highlighted. The subject of heat transfer between mine air-way walls and the ventilating air current is, however, not new. It has been worked notably in South Africa and Europe since more than two decades. Stress was laid on the importance of determining thermophysical properties of mine rocks, viz., heat conductivity and thermal diffusivity. The techniques of in-situ measurements were described. The thermal conductivities of the core samples at higher temperature upto 500° have been studied and empirial relations obtained. The energy-mass exchange between rock and air was treated mathematically to predict mine climate. By using equations of mass, momentum and energy conservation and Claperoyn's equation, air quantitites, velocities, pressure, density, temperature and humidity of air could be calculated. The heat loading of mine workings and natural ventilating pressures were also interrelated. The state-of-the-art of air-conditioning practices and air-conditioning equipment manufacture in Federal Republic of Germany, UK, Poland and Hungary were presented. It was clear that in the mine air-conditioning equipment manufacture, the Federal Republic of Germany has an edge over other countries. A critical review of the indices of mine planners was also made by one of the authors. A simple method of absorbing heat by use of chilled water for dust suppression during coal winning by power loaders was

suggested. A novel method of hydraulic fracturing of rock and fluid circulation through fracture planes which act heat cxchange planes was also suggested.

In India, the subject of heat transfer between the mine air-way walls and the ventilating air attracted superficial attention of the mining industries and mining educational institution. For mining at a greater depths, which the copper mines in our country are going over, systematic and scientific studies should be conducted. The educational institutions should give the necessary mathematical approaches to solving the heat exchange problems besides expanding their Rock Mechanics Laboratories to include set-ups for determining thermo-physical properties of mine rocks.

DR O K GARG, Professor in Plant Physiology, Institute of Agricultural Society Banaras Hindu University, Varanasi. attended the III INTERNATIONAL CONFERENCE ON IRON NUTRITION AND INTERACTIONS IN PLANTS at University of Nebraska, Li Nebraska, USA. A total of 72 participants took part in the proceedings which were grouped into the following categories : (a) soil chemistry and iron interactions; (b) genetic variability and Plant breeding; (c) root rhizosphere & microorganisms; physiology and biochemistry and (e) correction of iron deficiency.

The participant presented two research papers relating to physiological significance of iron with special reference to delaying in senescence and nitrogen-fixing efficiency in plants. Using french been (*Phaseolus vulgaris L.*) as experimental material, it was reported that a judicious combination of iron and zinc (5-10 ppm) in the form of fertilizers, can delay senescence and maintain photosynthetic efficiency of plants for a longer time. Iron heps to maintain chlorophyll apparatus at cellular level and thereby they are able to entrap solar energy and utilize them in photosynthesis for a longer period. This has also significance in raising the source sink potentiality of plants and increasing the yield of crops. Application of zinc acts as an additive factor to the synthesis of IAA in plants, which has positive bearing on their growth activities.

In another paper, it was reported that application of iron to soils along with zinc (50-10 ppm) apparently substituted rhizobium cultures. The french been plants grown in soils without rhizobium cultures, but supplied with Fe, showed the formation of root nodules. This should be considered important for improving the nitrogen-fixing ability of legumes.

Major Results Reported at the Conference

(a) Iron chlorosis is closely related to differences in Fe-placement, rate, time of application, weather and soil conditions. There is considerable promise by developing more Fe-efficient cultivars and effective Fe-fertilizers. The best

method to control Fe-chlorosis in the future will be a combination of Fe-efficient cultivars with the best soil management practices and using reasonably effective fertilizers. Besides these, biofertilizers and phytosiderophores can also be helpful to correct the iron deficiency problems in soils.

(b) Iron efficient cultivars be developed which should also be more efficient in photosynthesis and protein synthesis.

(c) Great care must be taken that while correcting Fe-chlorosis, unfavourable side-effects should not develop in plants or soils. Possibility of using sludge and industrial wastes be worked out to improve the iron-status of soils and thereby the yield potentiality of crops.

(d) Chemistry of iron in status relation to Fe-chlorosis be critically examined. Use of iron with other elements like zinc be tried to develop a combination of fertilizers, which should be economical in raising the yield of crops. It should be stressed that results of Fe-researches on crop plants should be so practical that it is accepted by farmers.

(e) There is considerable scope of researches on redox-potential in plants and its impacts in iron stress and microbes in soils.

(f) Researches should be extended to find out the site of iron-stress at cellular level and the genes responsible for it.

Recommendations/Conclusions Arrived at the Conference

(1) The essential role of iron (Fe) in biological world is impressive and the manner in which the Fe supply is controlled to the plant or organism is unique in making Fe available for use. The participants presented theirspec ific approaches to answer detailed objective in a designated line of reserach such as (a) release of hydrogen ions, (b) release of reducing plant roots, (c) reduction of Fe^{3+} to Fe^{2+} by plant roots and (d) increase in organic acids (particularly citrate) in plant roots. Each of these factors were elaborately discussed in view of the existing hypotheses emphasising reduction by roots at the plasma membrane and with regard to how all these factors may compliment each other in the absorption processes.

Discussions were also extended to expedite the availability of Fe to Fe-deficient plants. It was considered that hydroxamate siderphores of microbial origin may help in the availability of Fe in tomatoes.

It was concluded that there is no *one* scheme controls the use of iron in the biological world except the reduction of Fe^{3+} may be the single most important factor. Other interactions with Fe discussed were K, Mn, N, bicarbonate and reduction of Fe^{3+} to Fe^{2+} by ultra-violet light.

2. A stress in crop production is considered something that decreases yield and a growth promoter is something that increase yield. Many times, several inputs that improve crop production are considered to be not related to stress. In other words, a stress is an external factor that decreases yield of crop from yield maximum to a lower level. Examples are diseases, insects, salinity and excess elements.

It was discussed and realised that, besides the above, plant nutrients, growth regulators or genetic limitations are directly related to stresses; rather these factors are considered as promoters to plant yields. It was emphasised that when plant nutrients are not in optimum amounts of ratios, their deficiencies and imbalance are true stresses; they decrease crop yields just as do other stresses. If a yield is not maximum, it is due to the additive accumulation of all stresses. Nutrient deficiencies and imbalances are yet a major barrier or stress to obtain the potential of yield maximum. If yields are increasing it is because of removal or overcoming of stresses.

3. The physiological significance of iron-nutrition of plants was also elaborately discussed during the symposium. As regards the functions of iron in chloroplasts, it is involved as a constituent of many Fe-containing electron carriers (e.g. ferredoxin, cytochrome-f and some membrane-bound Fe-S proteins). It was suggested that Fe may be required for the formation of specific complexes of the thylakoid membrane itself.

It was further pointed out that genotypic responses to iron-stress varies considerably. The productivity decline in different cultivars ranges from 20-60%. Iron-stress causes chlorosis which not only affects the quantity and quality of chlorophylls, but it also disturbs the photosynthetic carbon flow of disordered plants.

DR RAMESH SHARMA, Assistant Professor, Department of Life Sciences, Manipur University, Canchipur, Imphal, attended the XIII INTERNATIONAL CONGRESS OF GERONTOGY & INTERNATIONAL GERNOTOLOGY WORKSHOP at New York Hilton in New York from 12-17, July, 1985 and Gerontology Research Centre, Baltimore from 18-19 July, 1985. Aging is a universal phenomenon. The whole world is conscious about the causes and mystery of old age. People are working in different disciplines of the phenomenon of aging. The objective is to ensure greater health and not the prolongation of the years lived. The International Association of Gerontology, founded early in 1950 as a multidisciplinary organization, held its meeting for face-to-face discussion on various aspects of aging processes. The XIII International Congress of Gerontology was particularly well timed to events that are transpiring in regard to the elderly through out the world. The programme of this conference was designed to meet the educational needs of a broad spectrum of scientists, practitioners and administrators. The Congress was inaugurated by the President of the International Association of Gerontology (IAG), Professor Ewald W Busse. An official of the Health

Department of the US Government and the Senator Astronaut John Glenn addressed the meeting signifying the importance the US Government gives to the problems of the aged. The whole programme was devoted to four main areas of concern: biology, clinical medicine, behavioral and social sciences, and social research, planning and practice. The main theme of the conference was "Aging : The Universal Human Experience". An important event during the congress was Sandoz award lectures given Professor Sir Martin Roth of England on psychogeriatrics and Professor Karl Esser of West Germany for his studies on plant aging.

There was a separate programme for the developing country participants. This was supported by United National Institute of Aging, USA, Helpage International, IAG and WHO. The programme started with the presidential address by Dr E W Busse of IAG then followed by the lectures of Dr T Shuman, Chief, Aging Unit, United Nations, Dr Gary Andrews, Convenor of the programme planning committee. Professor M S Kanungo, (Varanasi, India) was one of the members for the same programme. The differences in the approach towards the elders in the developing and developed countries were noticed.

It was reported during the Congress that the immune system in general looses its ability to fight with various kinds of dieases as a function of age. Some researchers theorized that hormone receptors, rather than the hormones themselves, are to blame for some disruptions caused during aging. Dr George S Roth and colleagues, Gerontology Research Centre, Baltimore City Hospitals, have found that the concentrations of certain key receptors diminish substantially with age. Different workers put various theories for aging of an organism. These are : Gene regulation, Error, Age pigment, Membrane transport-, Immunological, Cross linking and free radical, Food restriction- and somatic mutation theory of aging.

The delegate presented a paper on 'Regulatory changes in enzymes of oxaloacetate metabolism in the brain of aging rats'. Oxaloacetate is a physiologically important intermediate of several metabolic pathways. These pathways may either be catabolic (i e Krebs cycle) or anabolic in nature. It is of much importance for brain tissue because approximately 75% of the free aminoacids of the brain are accounted for by aspartic acid, glutamic acid, -keto glutaric acid, oxaloacetic acid and their derivatives. Hence, oxaloacetate is essential for the production of energy and synthesis of other important compounds inside the cell. Therefore, studies were undertaken to measure the activities, and regulation of the enzymes of oxaloacetate metabolism in the brain of young (6-), adult (30-) and old (90-week) male rats to elucidate certain basic causes of aging at the molecular level.

The activity of cytoplasmic asparatate aminotransferase (c-AsAT) of the brain increases by 32% until adulthood (30-weeks) and remains constant thereafter with the advancing age of the rat. The higher activity of c-AsAT in the brain of adult and

old rats may be correlated with a higher degree of transamination during these phases of the life span of the rat. The activity of mitochondrial-AsAT, on the other hand, decreases as a function of age. Hence, it is likely that the process of transamination in the mitochondria diminishes in the brain of aging rats. The endogenous levels of both the isoenzymes of AsAT are depending on the different types of physiological control. The specific activities of both the isoenzymes of malate dehydrogenase (c-& m-MDH) and citrate synthase (CS) show a gradual inm-MDH are the enzymes of a metabolic pathway which is oxygen dependent, it is likely that the increase in their levels in old age may be an adaptation to an increase in the aerobicity of this tissue. The amount of CS and m·MDH in the cell is directly correlated with the ability of the cell to utilize oxygen. The higher activity of c-MDH in the brain of old rat may be a contributory factor for the higher flow of oxaloacetic acid towards Krebs cycle.

The activity of Phosphoenolpyruvate carboxykinase (PEPCK) of the brain is significantly higher in the adult rat as compared to those of the young and old rats. The higher activity of the animal during this phase of its life span. The decrease in the enzyme activity in old age may be correlated with the more utilization of oxaloaectate for c-MDH. This decrease in enzyme activity may also be due to the decreased rate of synthesis of corticoids as a function of increasing age of the rat since this enzyme is regulated by corticosteroids.

The present findings show that the changes in the normal levels of the enzymes and also their regulations are age-dependent. In general, induction of enzymes by hydrocortison is impaired or reduced in old age which may be due to a change in the level and specificity of receptor proteins that bind to the corresponding hormones.

Such alterations in the endogenous levels of these enzymes may be due to the regulatory changes in the corresponding gene(s) which are brought about by specific programme. Such changes may be responsible for the aging of an organism.

Forthcoming Seminars/Symposia/Conferences etc.

CODATA sponsored Workshop on Standardization of Environmental Data at Toronto, Canada in May 1986.

IUIS sponsored VI International Congress of Immunology at Toronto, Canada from July 6-8, 1986.

IUBS sponsored International Conference on Differentiation Patterns in Higher Plants at Zurich, Switzerland from July 13-18, 1986.

XXX International Conference of IUPS at Vancouver, Canada from July 13-19, 1986.

X International CODATA Conference at Ottawa, Canada from July 14-18, 1986.

XV General Assembly of CODATA at Ottawa, Canada from July 18-19, 1986.

IUPHAR sponsored Third World Congress of Clinical Pharmacology and Therapeutics at Stockholm, Sweden in July 1986.

IMU sponsored International Congress of Mathematics at Berkeley, USA from August 3-11, 1986.

IUBS sponsored III International Conference on Aerobiology at Base, Switzerland from August 6-9, 1986.

IUPAC sponsored VI International Pesticide Chemistry Congress at Ottawa, Canada from August 10-17, 1986.

IUGS sponsored IV Kimberlite Conference at Perth, Australia.

IUBS sponsored XXII International Horticultural Congress at Davis, USA, from August 11-20, 1986.

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Second EUCHEM Conference on the Electronic Structures of Transition Metal Complexes at Maynooth, Ireland (B Singh); Gordon Research Conference on Magnetic Resonance at New Hampashire, USA (C L Khetrapal); V International Conference on Surface and Colloid Science at New York, USA (V Sitakara Rao); International Astronomical Union Symposium No. 117 on Dark Matter in the Universe at Princeton, New Jersey, USA (Bhaskar Datta); Microscience Conference at Balton, Hungary (S R Prabhakaran Nayar); IV Asian-Pacific Corrosion Control Conference at Tokyo, Japan (UK Chatterjee); First Circum-Mediteranean Region Conference at Malmo, Sweden (K D Broota); Session of International Bureau of Mining Thermophysics at Stenhope Bretby, UK (M A Ramlu); III International Conference on Iron Nutrition and Interaction in Plants at Nebraska, USA (O K Garg); XIII International Congress of Gerontology and International Gerontology Workshop at New York, USA (R Sharma).